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DATE: 17 January 1962

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MATERIALS - SILVER-COPPER-LITHIUM ALLOY -
17-7PH SANDWICH PANELS BRAZED WITH - EFFECTS
OF ELEVATED TEMPERATURE ON - STRUCTURAL
EVALUATION OF

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TEST DATA MEMORANDUM

R-TDM NO. 2205
MODEL B-58
TEST NO. E-8725

TEST: MATERIALS - SILVER-COPPER-LITHIUM BRAZING ALLOY - 17-7PH STAINLESS STEEL PANELS BRAZED WITH EFFECT OF ELEVATED TEMPERATURE ON STRUCTURE & EVALUATION OF

OBJECT:

To evaluate the effect of oxidation in air at 700 F on stainless steel sandwich panels brazed with sterling silver plus 0.2% lithium.

TEST SPECIMENS & PROCEDURE:

A 1/2" x 13" x 25" sandwich panel was brazed with sterling silver + 0.2% Li brazing alloy. After brazing, the panel was vacuum purged with air ten times. It was cut into specimens as shown in Figure 1, and exposed as described in Table IIIa. The specimens were tested at room temperature on a 120,000 lb. Baldwin test machine. A second panel was brazed but not tested because of the results obtained from the first panel. Four 1/2" x 1" x 2" panel specimens were exposed as indicated in Table IIIb. These specimens were examined visually.

RESULTS & DISCUSSION:

The results of the mechanical tests are given in Tables I and II. Photomicrographs showing the extent of oxidation in the brazed fillet are shown in Figure 2. Contrary to expectation, the specimen strength was as good or better after exposure as it was before exposure. The high strength after exposure was probably due to additional precipitation hardening of the steel during exposure. A corrosion condition previously observed on PH15-7 Mo brazed panels was found on the 17-7PH stainless steel panels of this test. Corrosion occurred on the steel adjacent to the brazing alloy-steel interfaces. It was most evident on the outer edges of the exposed honeycomb core. The condition was not evident immediately after cooling to room temperature. It apparently developed as the specimens stood in the moist air of the laboratory. The corrosion appeared as small brown growths or scale. The cause was not determined.

CONCLUSIONS:

1. After exposure in air at 700 F for periods up to 300 hours, 17-7PH stainless steel sandwich panels with adequate fillets, brazed with sterling silver + 0.2% Li, have strengths equal to or better than similar panels in the as-brazed condition.
2. A new type of corrosion of brazed 17-7PH stainless steel panels was observed during this investigation. The mechanism of attack was not determined.

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DATE 10/12/59

*See Supplemental Sheet S-1

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 A DIVISION OF GENERAL DYNAMICS CORPORATION
 (FORT WORTH)

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CUTTING DIAGRAM

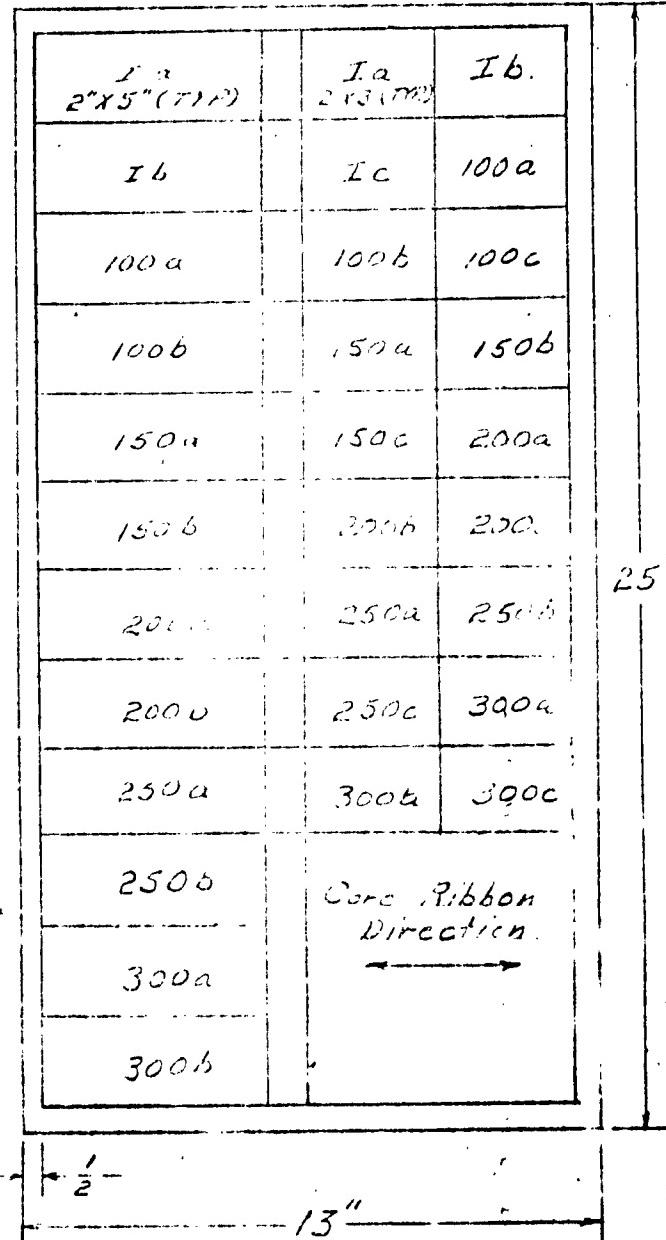


Figure-1

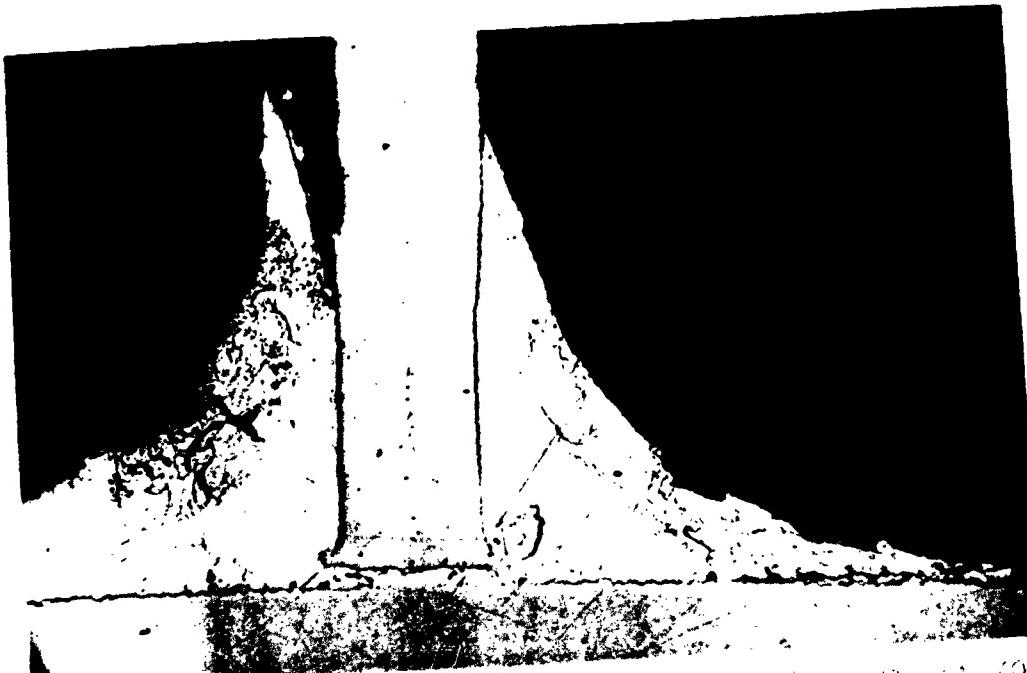
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Shear Beam Specimen Fillet. Exposed 3 months at 700 F.
Approximate depth of oxidation - .005" Mag. 250X
Unetched.



Shear Beam Specimen Praze Fillet. Exposed 3 months at 700 F.
Approximate depth of oxidation in fillet - .005" Mag. 250X
Unetched.

Figure 2

CONVAIR—FORT WORTH
EDC, COMPRESSION VALUES FACSIMILE
TABULATION SHEET EXPOSURE PANEL BRAZED ON GRAPHITE

SAMPLE NO.	TEST TEMP. °C	TEST TEMP. °F	SKIN GAGE	TYPE FAILURE		
				U/I A.S.I.	U/I A.S.I.	U/I A.S.I.
T-a	none	R.T.	0.010"	core-core		
b				202.8	213.3	
c				202.0	202.0	
AVERAGE				205.4	205.4	
100-a	100			202.5	core-core	
b				223.6	core-core	
c				215.0	core-core	
AVERAGE				213.7	core-core	
150-a	150			210.8	core-core	
b				194.2	core-breeze	
c				214.5	core-breeze	
AVERAGE				205.5	core-core	
200-a	200			200.2	core-core	
b				227.4	core-core	
c				217.2	core-brazed	
AVERAGE				215.3	core-core	
250-a	250			226.8	core-core	
b				223.1	core-core	
c				215.5	core-core	
AVERAGE				221.8	core-core	
300-a	300			223.6	core-core	
b				222.9	core-core	
c				222.8	core-core	
AVERAGE				222.8	core-core	

CONVAIR-FORT WORTH
TABULATION SHEET

STEAM BEAM VALVES FROM AIR EX-
POSURE PAINT - BRAZED ON GRAPHITE

SAMPLE NO.	HRS @	TEST TEMP.	SKIN GAGE	fsc		PSI. TROE FAIL.
				3"	Core shear	
T-a	NONE	R.T.	0.010	970	925	
b				925	958	
Avg						
100a	100			940		
b				875		
Avg				902		
150a	150			1000		
b				920		
Avg				935		
200a	200			975		
b				925		
Avg				950		
250a	250			850		
b				855		
Avg				852		
300a	300			1075		
b				900		
Avg				989		

FTDM 2355

CONVAIR - FORT WORTH
TABULATION SHEET

LIST OF SPECIMENS & EXPOSURE CONDITIONS

SAMPLE NO	TIME HRS.	TEMP DEG.F	SECTION III		
			a	b	c
100a	100	700	None	None	None
100b	100	700			
100c	100	700			
150a	150	700			
150b	150	700			
150c	150	700			
200a	200	700			
200b	200	700			
200c	200	700			
250a	250	700			
250b	250	700			
250c	250	700			
300a	300	700			
300b	300	700			
300c	300	700			
416	100	650			
436	300	650			
417	100	700			
437	300	700			

SUPPLEMENTAL INFORMATION

The data presented in this report is supplemented with the following information:

- A. The panels for these tests were brazed and processed in accordance with standard production procedures for B-58 panels. The brazing and heat treatment cycle was as follows:

1. Braze at $1665^{\circ}\text{F} \pm 25^{\circ}\text{F}$ for 10 minutes.
2. Cool to $1400^{\circ}\text{F} \pm 25^{\circ}\text{F}$ and hold for 90 minutes.
3. Cool to room temperature and refrigerate to $-20^{\circ}\text{F} (+0^{\circ}\text{F}, -10^{\circ}\text{F})$ as rapidly as possible and hold for at least 60 minutes.
4. Allow panel to return to room temperature and then age at $1050^{\circ}\text{F} \pm 10^{\circ}\text{F}$ for 90 minutes.
5. Cool to room temperature.

- B. The preparation and testing procedures for the test specimens were as follows:

1. Edge compression Test

- a. Specimen size is $2.00'' \times 3.00'' \times$ panel thickness.
- b. All edges are filed and sanded smooth to remove nicks and saw cuts which might induce premature failure and are filed with a soft machinable plastic material.
- c. The $2.00''$ edges are machined square and parallel to a tolerance of ± 0.001 inch per lineal inch.
- d. The test machine loading head and platen are checked for parallelism and adjustments made to insure parallelism. Test specimens are placed in the machine with the $3.00''$ edges normal to the bearing surfaces.
- e. Testing is accomplished by applying a continuous load to the $2.00''$ edges at a rate of 8,000 pounds per minute until failure.

2. Shear Beam Test

- a. Specimen size is $2.00'' \times 5.00'' \times$ panel thickness.
- b. All edges are filed and sanded smooth to remove nicks and saw cuts which might induce premature failure. The $5.00''$ edges are filled with a soft plastic material.
- c. Specimens are tested and supported as a simple beam with a $3.00''$ span.
- d. A continuous load is applied at the center of the span at the rate of 500 pounds per minute until failure.